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Accessibility guidelines for the development of Learning Objects

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Abstract

This article presents a set of guidelines for creating learning objects accessible, with the intention of guiding and helping teachers developers of learning objects in developing materials accessible through the provision of alternative media or equivalent. These guidelines are created based on analysis and convergence of the "Principles of Universal Design" with the "Recommendations for Creating Accessible Web Content" W3C, and "Best Practices for Production and Application of Accessible Content" presented at Guides Instructional Management Systems (IMS). The guidelines were tested by experts who develop and provide content for digital learning environments, which were capable of producing accessible learning objects, according to the set of guidelines proposed.

Key-words: Distance education; learning objects; accessibility

1. Introduction

The requirement of the job market for creative individuals, qualified and innovative created the common goal of upgrading and lifelong learning. The common search for specific and immediate knowledge, (characteristic of andragogy) makes education, which still focuses on the formal creation of courses and content organization in the industrialized format, be more flexible and appropriated to the profile and needs of users.

The Brazilian programs of distance education are mostly linked to fixed structures of curriculum, with content organized into domains and supported by management systems, but follow the trend of proliferation of technology and grow substantially in all levels of education, supported by Law of Directives and Bases of Education - LDB, Law no. 9394/96, art. 80: "The Government shall encourage the development and broadcast of distance learning programs at all levels and types of teach and continued education" [1].

The expansion of the technologies used in e-learning, allows all digital media to be made available in supporting

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systems such as VLEs, STIs, e-books, SHAEs, instructional video, etc. This teaching method makes extensive use of digitized materials, at different levels of interactivity, present in all levels of learning. The study materials are prepared by teacher authors or groups of content development authors worldwide, according to a time consuming and expensive generation process.

1.1. Learning Objects and accessibility

Aiming to locate content available on the web and reuse them in different educational situations, learning objects have emerged. These resources, although there are disparities between the various authors in the definition of learning object resulting from the classification approaches, are most often defined according to the Institute of Electrical and Electronics Engineers (IEEE) [2], as any digital entity; a text, a movie, an animation, an instructional content, etc., or a composition of these bodies into larger objects, with defined educational purpose.

International organizations: IEEE - Learning Technology Standards Committee (IEEE-LTSC); Dublin core, Instructional Management Systems - Global Learning Consortium (IMS GLC), the Advanced Distributed Learning - Sharable Content Object Reference Model (ADL-SCORM) and World Wide Web Consortium - Web Content Accessibility Guidelines (W3C-WCAG), collaboratively work in the standardization and specification of construction, storage and distribution of these objects, to facilitate and ensure a high level of global relevance and applicability to their specifications.

Learning objects, when referenced in accordance with international standards and independent of platforms, can be located and reused, either alone or in the composition of larger objects, with defined goals and educational strategies, in different educational contexts. Thus, the current concern of researchers is the quality of learning objects distributed on the Web, at the virtual learning environments and learning objects repositories.

Insofar as technology evolves and enters the educational system, accessibility issues are grown, with the creation of potential access barriers. In the systemic approach to online education, the more suitable combinations of content, media and technologies are offered, the greater the scope and accessibility of the created content.

Accessibility issues in Web content are discussed mainly by the Web Accessibility Initiative (W3C-WAI) and the IMS-GLC-ACC (Accessibility Guidelines.) Within the W3C documents, the closest accessible to the creation of learning objects is the Web Content Accessibility Guidelines (WCAG) [3, 4] with general scope in the development of web contents. IMS recommendations and accessibility standards are tackled in the specifications: IMS GLC-ACC (Accessforall Metadata, IMS-ACCLIP - (Accessibility for Learner Information Package), and IMS - ACCGuide - Guide for Developing Accessible Learning Applications) [5]. "Web content, according to W3C-WCAG, refers to information in a Web page or a Web application, including any text, images, forms, or sounds."[6].

In the perspective of universal design, a product is universally accessible if it is apparent, reached to all individuals without adaptation. It is not about developing other specific content and directed to supply a deficiency, but to provide people with disabilities, access to such information. In the learning objects, according to NCAM, CAST [7] adaptations of access can change the nature of a content and divert attention from the main aim of learning, so in inclusive education, all individuals should have access to the same didactic and pedagogical content; they must have the same perception about everything that is presented, without loss of information or detriment of content relevant to the understanding of the subject.

Accessibility should be considered from the beginning of the project of a learning object, and not an adaptation after its creation.

Moreover, the extensive amount of existing recommendations that focus on the implementation and distribution of content to the Web in an accessible way; and the lack of targeted support to content authors to make their learning materials accessible becomes a barrier in the construction of accessible learning objects.

Seeking to minimize the problem there were proposed the thesis research that aimed at answering the following question: How do content authors can build learning objects based on norms, standards and recommendations for web accessibility and in the universal design principles, appropriate to their educational objectives, without the need to create adapted versions to each disability?

1.2. Guidelines of accessibility in leaning objects

Accessibility in learning objects needs to be as an integral aspect of the design process and not as a separate or additional activity. The observation to the legal determinations implies that any education object should be accessible to all students or at least provide equivalent alternatives when necessary. The strategies for accessible content involve not only the time and work to make existing content accessible, but policies for the production of any new accessible content.

Accessible learning objects should ensure their usability by anyone, anywhere, regardless of physical, technical, or environmental limitations, easing the customized teaching-learning. Perry and Ball [8], argue that the idea of personalized learning objects in this period is still young and undeveloped, and Burgstahler [9] shows that learning objects become accessible when they follow the principles of universal design.

1.3. Methodological procedures

The research is of applied nature, and qualitative, based on publications in books, printed and digital journals, and documents of international organizations for the creation of guides, standards and recommendations for Web content creation. The followed methodology comprises the following steps:

The search for the state of the art about development and use of learning objects was done through literature research, focusing on recent publications in the areas of distance education mediated by computer, learning objects and digital accessibility. From this information, influent and relevant items in the determination of guidelines for the creation of accessible learning objects were filtered. The equalization of information collected on publications, standards, principles and recommendations of best practices in creating learning objects, and of accessibility of web content; through inductive analysis, allowed the establishment of a set of guidelines for accessible learning objects creation.

The created guidelines were made available to teachers for them to prepare teaching materials by following these recommendations. Aiming the unity of presentation for evaluation of the applicability of the guidelines, it was developed a creating learning objects model, with a neutral instructional and didactic approach.

For observation of the validity of the proposal, it was established an intentional sample composed of collaborating teachers, working in higher education institutions and experienced in the development of digital educational content.

1.4. Accessibility in distance learning

The accommodation of individuals with disabilities in distance learning courses through the Web is consistent with web accessibility in general, seeking to provide a greater degree of independence to the individual. The barriers to the accesses to the Web can be minimized by the designer, by the browser, by the assistive technology, or by the operating system.

Some developers believe that to make their material accessible, they can simply use the text-only presentation;

however, the main criterion for developing an accessible content is that the user, who is accessing this content with text alone, gets the same information that those users who access the same content in a media rich format [10].

One way to allow access to the pages and digital materials for a distance course, as well as to the entire Web, is the application of the principles of universal design, more sensitive to the individual preferences and abilities, in the content creation, without the need of adaptation or special designed for people with disabilities [9].

Universal design attempts to meet the needs of everyone, includes in the design process, people of all ages, physical, sensory and cognitive abilities; emphasizing skills, and including social, historical, anthropological, economic, political, technological, and especially ergonomics and usability issues [9, 10].

Products designed under the principles of universal design make the work easier for individuals, even those without disabilities. The telephone, typewriter, speech recognition, optical character recognition and speech synthesizers, are examples of products inspired by the disability of individuals [6].

2. Guidelines for Content Development of Accessible Learning Objects.

The guidelines established are derived from the general accessibility recommendations of the international organizations: IMS-GLC and W3C-WCAG, as well as the "Principles of Universal Design", applied to Web content creation. From these recommendations, there we selected those which, if observed by the learning objects authors in the act of creation, it should extend the use of this object to learners with possible disabilities.

The definition of media used in creating a learning object is derived from the analysis of the goals of the learning resource, and the instructional strategies adopted. Thus, it is understandable that the author while defining the content, sequence, segregation, approaches, and Medias of presentation, may expand the accessibility of their learning object, following the proposed guidelines.

To support the teacher's task to insert factors of accessibility, there were created the guidelines presented herein. These constitute a sufficient and synthesized set of recommendations, structured on topics targeted to each type of media possible to be used on the construction of the learning object.

Each media element considered presents the general recommendations of accessibility in the creation content in this format, indicated by the researched organizations, and the description of the alternative or equivalents media to make the object of learning accessible. Next are presented the used media and the respective guidelines for making learning objects accessible with these media.

a) MOVING IMAGES:

They may be: Standalone videos, videos with sound, animations, scripts.
Every moving image must present:

- Alternative media, at least one option.
- Alternative text and/or equivalent text for the whole video or at least the most relevant parts.
- Title or a description of the image's subject.
- Possibility of monochromatic visualization.
- Sound and image synchronized.
- Audio, when there is, without ambient sound.

- ALTERNATIVE MEDIAS

  It is an alternative access format, as another option of media, usually written text, which may be:
  - Alternative text,
  - Textual transcription of the video,
  - Extended audio description,
  - Audio description synchronized with the video,

- Subtitles or captions,
- Interpretation in signal language.

- ALTERNATIVE MEDIA: ALTERNATIVE TEXT

It is a descriptive, explanative and brief identification of the content and of the video's purpose. The alternative's text description depends on the movie's context.

Objective: Meet access device's deficiencies and visual impairment.

- ALTERNATIVE MEDIA: TEXTUAL TRANSCRIPTION OF THE VIDEO

It is a textual description of the video's scenes and its impact, if in the movie's sequence this is in fact relevant.

Beyond the speech, the environment, the aggregated sounds, the movements, and every aspect indeed relevant for the content's comprehension are also described.

Objective: Meet access device's deficiencies and both visual and hearing impairment.

- ALTERNATIVE MEDIA: EXTENDED AUDIO DESCRIPTION

It is an audio track such as MP5, without background sound, that describes all the events of the video: scenery, actions, and expressions, important for the comprehension of the content. It is a narration that explains the scene, differing thus from subtitles that translate speech.

Objective: Meet access device's deficiencies and both visual and hearing impairment.

- ALTERNATIVE MEDIA: AUDIO DESCRIPTION SYNCHRONIZED WITH THE VIDEO

It is a second version of the video containing complementary scenarios, characters and scenes relevant for the comprehension, used when speech subtitles are not enough for the understanding of the scenes.

Objective: Meet both visual and hearing impairment.

- ALTERNATIVE MEDIA: SUBTITLES OR CAPTIONS

The sound of the video is transcript in subtitles that contain every single spoken sentences of the script.

The textual description of the related sounds relevant for the comprehension of the content is transcript in captions.

Objective: Meet hearing impairment and cognitive handicap.

- ALTERNATIVE MEDIA: SIGNAL LANGUAGE INTERPRETATION

It is s synchronized video presented in the same screen as the original video, of an actor fluent in signal language.

It is used when subtitles or captions are not enough for the comprehension of the video or animation ou audio description.

Advantages over subtitles: They transmit, as speech, emotion and intonation.

Objective: Meet hearing impairment and cognitive handicap, for literate in such languages.

b) STATIC IMAGES:

Photographs, diagrams, graphs, charts, tables, drawings, ansii art, logos, buttons, images as links.

Guidelines:

Every static image, or so to speak, without movement, must have:

- Alternative media for every image.
- High contrast
- Scalable

- ALTERNATIVE MEDIA FOR STATIC IMAGES:

It is another format of media, such as:

- Alternative or equivalent text
- Complete equivalent description
- Optional grayscale image
- Simplified image for touch printing.

- ALTERNATIVE IMAGE FOR STATIC IMAGES: ALTERNATIVE TEXT

It is a text with the very same purpose as the image:

- It is short, objective and has less than 150 characters. It is fully read by screen readers.
- Decorative images or formatting should not have alternative text.
- In image link or buttons, the alternative text must cover the content of the image.
- The text must flow with the context of the page, as an item of a link list.
- If a brief alternative text is not possible, create a link for a more detailed description.

Objective: Meet access deficiencies, visual impairment and cognitive handicap.

- ALTERNATIVE IMAGE FOR STATIC IMAGES: COMPLETE EQUIVALENT DESCRIPTION

It is a complete textual description in an URL, having the content equivalent as the image. It complements the alternative text, in the impossibility of brief summarization. It is read by screen reader or printed in Braille.

Objective: Meet access deficiencies, visual impairment and cognitive handicap.

- ALTERNATIVE IMAGE FOR STATIC IMAGES: GRAYSCALE IMAGES

It is a grayscale version of the full-color images. Even if it is not apparent, its visualization must be tested.

Objective: Meet access deficiencies, visual impairment and color-blindness.

- ALTERNATIVE IMAGE FOR STATIC IMAGES: SIMPLIFIED IMAGES

They are equivalent but simplified images, which show only the most important items, which are made available for touch printers. When there is no other form of description, this method may be used.

Objective: Visual impairment.

- HIGH CONTRAST:

The combination of colors between the foreground and the background must be sufficiently strong to be seen by color blinds and monochromatic monitors.

Objective: Meet monitor access deficiencies, visual impairment and color-blindness.

- SCALABLE IMAGE

Every vectorial image or of high resolution must be scalable by virtual lenses up to 200% of its original size.

Objective: Meet visual impairment.

c) TEXTS:

For the printed reading, screen reading, audio information, tactile, image format, alternative text in alternative formats.

Texts include:

- Background in solid colors
- Switchable color, noticeable in gray scale
- Transformation in textual pages.
- Texts presented in an image format
- Structure and format
- Graphic or audible equivalents for texts

- CONTRASTING BACKGROUND, IN SOLID COLOR

Every text inside a learning object must have a solid color contrasting with the background. It must not have background image.

Objective: Visual and cognitive impairment.

- SWITCHABLE COLORS

Every information presented in color must have also the option to be presented in grayscale.

Fonts or different sizes, italic or bold, have the same purpose as colors in the texts.

Give preference to pastel colors for black text background. The best contrasts are given always by their complementary colors.

Objective: Meet access device's requirements, cognitive impairment and colorblindness.

- TEXT PRESENTED AS IMAGE
  - Cannot be read by screen readers or in Braille displays.

- Give alternative texts for these texts with the content of the texts.
- Chose always real texts over textual images.

Objective: Visual impairment

- TRANSFORMATION IN TEXT-ONLY PAGES.

It is a redundant textual information to the non-textual information, text-only pages are not recommended, for images are a strong element of motivation. There may be an option for the text-only visualization to prevent information loss.

- TEXTS: STRUCTURE, FORMATTING AND READING ORDER.

Prefer single column layouts, so that it is read in correct order.

- TEXT: LANGUAGE

Every text must contain:

- Clearness and simplicity in the used language.
- As few words as possible to present the content.
- Must be concise and factual.
- Adequate punctuation, for the perception of the voice synthesizers.
- Clear and objective writing style, in concordance with the content level, with language and terminology rigorously adequate.

- TEXT: TEXT STRUCTURE

To structure texts:

- Identify Headers, and other structural elements.
- Organize the content in a logical form and comprehensible order.
- Present topic hierarchy and enumeration.
- Do not use justified text nor centrally aligned.
- Use at most 80 characters per line.
- Break the text in segments, with well-defined titles, and supply printing version in one single page.
- Clarify abbreviations and acronyms on their first occurrence.

- TEXT: WORDS, ABBREVIATIONS, NON-USUAL EXPRESSIONS

Every text must contain:

- Definition of every word or uncommon expression, may it be in an alternative text or a link for the document's glossary.
- Word or sentence in its complete form must appear right before any kind of abbreviation.

- TEXTS: AUDIO DESCRIPTION FOR TEXTS

It is an audio record complementary to the visual text.

Objective: Meet cognitive and visual impairment.

d) TABLES:

For information presented in tables:

- Certify that the reading will be made linearly. The screen readers read line after line, continuously or by selected sections.
- Give clear identification for table title, header, rows and columns.
- Present table summary.
- If you have complex tables, separate them in simpler ones.
- Do not use tables for formatting, distribution of content or layout.
- Line, Pizza and Bar charts are converted into simple tables.
- Use caption and summary to describe the function of the table and its format.

Objective: Meet cognitive and visual impairment.

e) GRAPHS AND CHARTS:

Vertical bar charts, horizontal line charts, pizza charts, converted into accessible tables, or into a list.

Charts, when necessary, must have:

- Descriptive text of the chart's layout, the variable's locations and the presented results.
- Summary presented as subtitles.

f) AUDIO:

Content in audio must have:

- Subtitles, caption or complete description.
- Visual alternative text.
- Volume control, pauses, play, stops. All visible.

3. Concluding Remarks

In the literature studied we found large amount of existing recommendations that focus on the implementation and distribution of Web content in an accessible way but they did not offer direct support to content author teachers, because they focus more on the technical aspects of construction, and best practices recommended to Web - designers and implementers. To minimize this problem, was proposed this work which makes available guidelines, to help teachers developing accessible Learning Object. This research, considered the international guidelines and recommendations for the creation of learning objects from the IMS and SCORM, associated with the accessibility standards of the IMS, W3C-WCAG 1.0 and WCAG 2.0. These guidelines were tested by teachers, content creators and were able to help teachers in the development of accessible content, in the form of Learning Object, helping to increase accessibility in education.

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